



' 12 YEARS '

The Intergovernmental Panel on Climate Change (IPCC) announced in 2018 that humanity has only twelve years to prevent catastrophic climate change. Using the World Meteorological Organisation's definition of global average surface temperature, and the late 19th century to represent its pre-industrial level, the planet has just passed 1°C warming and is still warming at 0.2°C per decade, which would take us to 1.5°C warming by around 2040. Similarly, the average surface temperature is 1.2°C; warming at 0.25°C per decade means that the planet will be 1.5°C warmer by 2030 - only 12 years from 2018.

**This doesn't mean we have 12 years to act, or 12 years
before climate change arrives! IT IS HERE NOW.
We need to reduce emissions as fast as possible**

The IPCC is clear that by halving emissions by 2030, there is a 1-in-2 to 2-in-3 chance we can keep global warming below 1.5°C.

For every year that goes by in which we don't reduce emissions, another 40 billion tonnes of CO₂ are released into the atmosphere. We are leaving today's teenagers to clean this up and halt its adverse effects, such as major species extinction.

Extinction Rebellion has sprung up, against this backdrop, as a public movement challenging society to deliver the enormous changes required to stop global warming. The challenge for artists working with the Greenhouse Trust is to create artwork that communicates why, where and how we can transform our food-growing system into one that is both low carbon and contributes to thriving communities and wildlife-rich landscapes.



FUTURE GENERATIONS WILL BE GRATEFUL FOR YOUR ENDEAVOURS

What lies ahead is uncertain. This is a pivotal period; one that future generations will judge us by. There is a very short window of opportunity to avoid the worst disasters caused by climate change - we have already triggered the sixth mass extinction of species on our planet. It's not as if we are enjoying the fruits of this destruction; we are stressed, overweight and fearful.

I can't know all that I need to on every subject, so at times I reassure myself that the most important contribution to make is to bring organic values to every conversation. If we are guided by these values, of care, health, ecology and fairness in all that we do, we won't go too far astray.

Helen Browning OBE – Soil Association CEO



CLAIRE LEIGHTON

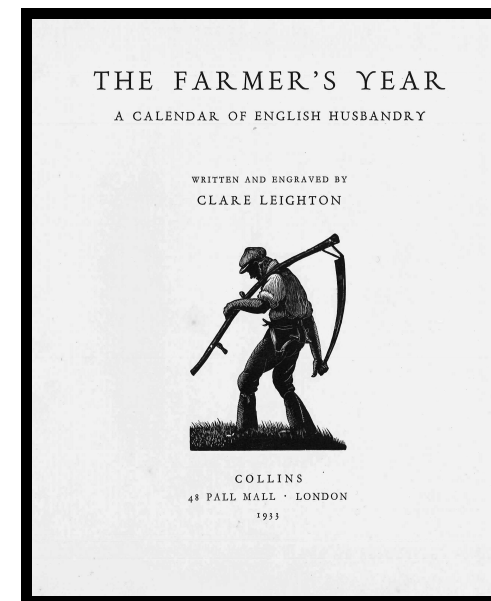
1898 - 1989

Claire Leighton was a printmaker and illustrator specialising in images of English farming and rural life. Her most famous works, including the twelve calendar prints which form part of this exhibition, were created in the 1930s and 1940s, before Rachel Carson's *Silent Spring* famously highlighted the devastating impact of industrialised farming and agricultural chemicals on our wildlife. While Leighton's images show a slightly romanticised version of the countryside, they also provide a sense of an age, not that long ago, when our countryside was a space not just for humans and machinery, but also for other creatures.

Helen Browning has agreed to help the Greenhouse frame its next series of exhibitions. These will build on our crucial soil and climate change themes and develop our work on the central role of women in creating environmental change.



Helen is an organic farmer and CEO of the Soil Association. She sets out the challenge in her book *Pig* and hints at the practical changes which might form a solution. These changes would increase contentment in our rural communities, and also potentially mark a step change in the contribution of urban food production, which would leave more land available for environmental protection and social enjoyment.



A LOCAL, ORGANIC FOOD MARKET – 2030 ?

Globally, the most sustaining environments have been overworked. Alongside the huge amounts of CO₂ released into the atmosphere, and the reduction in the ability of soil and vegetation to soak it up again, we have got to the point where the approximate weight of humans on the planet is 350 million tonnes, our farmed animals 1,010 million tonnes, and non-marine wildlife only 40 million tonnes. We and our livestock have squeezed out most other species.

Humanity's impact on the natural world, on which it ultimately depends – though we often seem to forget this – has been immense, and much of this impact has been through the way we produce our food.

Natural systems are very complex, with infinite interdependencies and usually very productive too. Our current ways of farming, even organic ones, aren't perhaps the most efficient ways of generating biomass and foodstuffs. Diversity is the watchword, in business as in ecology. We need to shift from simplicity to complexity, mimicking and working with nature to produce what we need. In my view, there's no problem with our ability to produce enough food if we move to more ecologically intensive methods. The idea of permaculture, where landscapes are designed to deliver a range of benefits, and the food producing components are more focussed on perennial crops, like shrubs and trees, rather than annuals such as cereals.

ORGANIC FARMING IS A SIGNIFICANT STEP IN THE RIGHT DIRECTION

The avoidance of artificial fertilisers and chemicals means that we have to follow time-honoured ways of building fertility, through legumes and rotations of crops and animals. Forbidding the routine use of antibiotics and other drugs makes us focus on good husbandry and our animals must be free-ranging whenever the weather permits. But it's not enough. To meet the challenges the world is facing, we need to do much, much more.

The problem currently is the economics of these systems as diversity increases harvesting costs, and makes processing and marketing less straightforward. These techniques need people, and could provide much meaningful and enjoyable work for the many folk whose livelihoods may soon be displaced by driver-less vehicles, artificial intelligence and robots. These systems also need local processing and distribution infrastructure so that healthy food can reach consumers with minimal packaging.

Land is where it gets complicated, because today that seems to be the limiting factor. Everyone wants land, to build homes and roads on, to make a living from, to play on, to protect nature on. Farmers seem to have bought the idea that our moral duty is to feed people, even while the market value of what we produce is so low that we find it hard to make a living without public subsidy. Egged on by the many companies who want to sell us products,

we have ended up with a denuded landscape of large fields and over-grazed hills, producing a few commodity crops, much of which is fed to animals that are confined indoors in ever greater numbers.

At the other end of the scale is the rapid development of novel crops. Algae, insects, seaweed, fungi and laboratory-produced meat have little reliance on land and may pass the test of energy, nutrient and water efficiency. This is also true of more novel farming techniques such as 'vertical farming' where crops are grown in stacked layers, under LED lights, and hydroponics, by which plants are grown in water.

A mix of ecologically intensive, perennially based cropping on the one hand, and high-tech approaches that are very resource efficient on the other, could allow much more of our land to be free to provide ecosystem services like carbon sequestration, water management, and plenty of space for other species to thrive and for people to enjoy and live in.

Helen Browning – Extract from 'Pig'

JANUARY - LAMBING



Farmers live close to the seasons, and the weather is our greatest uncertainty. I wonder whether the urban reader may be bemused by the constant focus on weather. Yet every day, it determines what we can do on the farm, and how we will do it.'

The damage we are doing to the world and to ourselves is becoming so apparent that even the most sceptical are at last starting to accept that we must do things differently. Then, Brexit creates a moment where everything is up for grabs, for good or ill. We have the opportunity to create a better way forward, one that combines traditional knowledge with the right kinds of innovation, to improve our soils, put animal welfare centre stage, farm without pesticides, and feed people well. Or we could end up with low standards for animals and the environment, imports of poor-quality food, and see farmers - especially the smaller ones - going out of business.

'This is the challenge for leadership: it must look beyond the political cycle, or the next quarter's financial reporting, and invest long-term in preventing the problems rather than being distracted by short-term fire-fighting. It must put the *values* rather than just 'value' at the heart of our food system. Can we, will we, grasp this opportunity to set a better course for humanity, one that accepts our interdependence with the natural world? But leadership is a shared responsibility. The onus is on all of us – politicians, pioneers, farmers, consumers, activists in our own spheres – to provide it.'

Helen Browning – Extract from 'Pig'

FEBRUARY - LOPPING

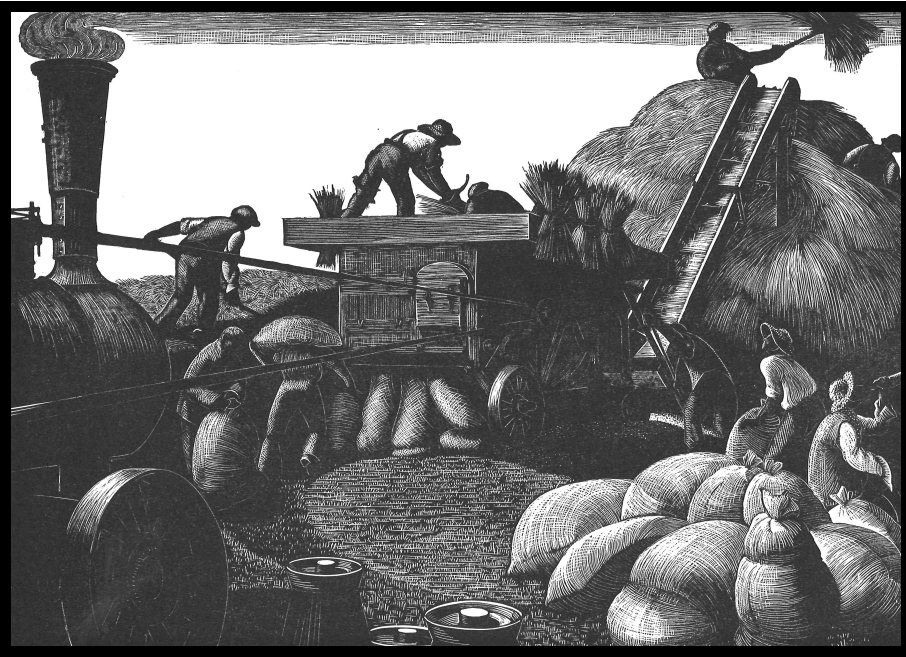


'As farmers, we need to concentrate on feeding the soil microbes, just as we humans need to concentrate on feeding our gut bacteria. Bag nitrogen has allowed us to short cut these principles that are at the heart of organic methods; our soils and health have borne the brunt of these short cuts.'

On an organic farm, nothing starts to grow until the soil temperatures are high enough for the leguminous plants to start moving, fixing nitrogen from the air to fuel the grasses around them as well as themselves. So while our neighbours are spreading manufactured nitrogen – 'sugar' as my father used to call it – we have to wait for the bacteria in the nodules on the roots of clover to do the job for us. This symbiotic relationship between nitrogen-fixing bacteria and plants that can host them is the main driver, along with recycled manures from livestock, of the organic farming system. 'Sugar' is a good name for artificial nitrogen. As the most important nutrient for plant growth, nitrogen encourages lush development, but when it comes from a factory rather than the soil, it contains none of the micro-nutrients that are important for healthy growth. It's very like the empty calories we ingest when we eat sweets; they give energy, but also upset our metabolism if we overindulge. Too much nitrogen thins the plant's cell walls, allowing pests and diseases to take hold more easily, and fuelling weed growth too, leading farmers into a cycle of spraying chemicals, virtually all of which end up being proven – usually after decades of use – to be very bad for the environment and for us. It's an unfortunate merry-go-round.

Helen Browning – Extract from 'Pig'

MARCH - THRESHING



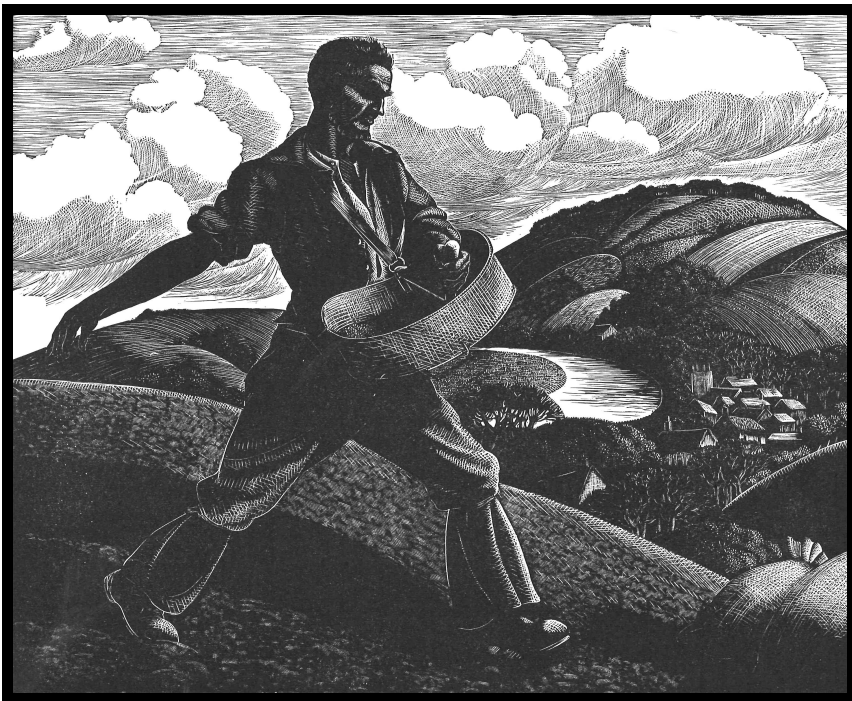
'Given the knife edge we are on, with only a few short years to prevent the worst ravages of man-made climate change, protecting the carbon stores in soils, especially peat soils, and promoting techniques that will help them store more, is a no brainer.'

So we organic farmers have to be patient. While surrounding fields are artificially green, we wait for warmth, for the bugs to start work. It's the time of year when it's possible to lose heart and yearn for an easy remedy. But then the magic starts to happen, and the nutritious clovers begin to grow, high in protein and omega-3 fatty acids, good for the animals, for us and the bees. In the autumn it's payback time for our patience in the spring; when all around, the sugar-fed grassland is depleted and lacking in goodness, our clovers power on, keeping animals satisfied and productive until late October or even November.

Fertilizers and pesticides have masked the problems the soil is facing for decades, and many of the problems we are now aware of have been building up for ages; they will take a concerted effort to reverse. And if farmers have only short-term tenancies on their land, or worse still, are just using it for a year to grow a specialist crop like potatoes, they may not have the incentive to think about the long-term impacts of their management. Farmers are so squeezed financially that they often feel that they cannot consider the long-term, just this year's profits.

Helen Browning – Extract from 'Pig'

APRIL – SOWING



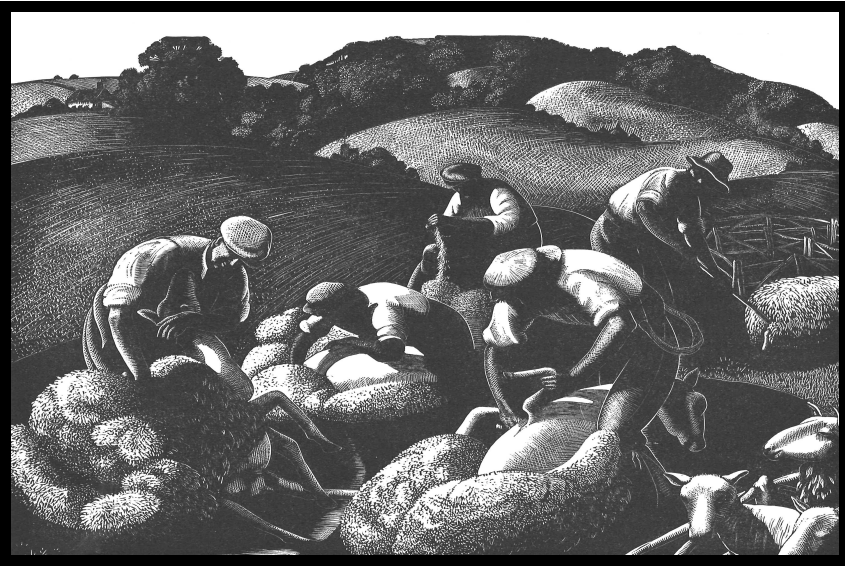
Farming is such a cycle. All summer we are preparing for the winter, conserving grass, clearing sheds of manures, baling thousands of tonnes of straw. Every month has its task list, but with the constant uncertainty of the weather trumping all our planning. Timing is everything, grabbing the opportunities we have, being ready for them and making the most of them. Patience too; to wait until the moment is right, and having faith that the conditions will come right, even if not on our command!

How we eat, and how we produce our food. These are the things it's easy to take for granted, even though the evidence of how wrong we've been getting it is all around us. We have squeezed out most other species, have degraded much of the planet's best soils - and thus our chances of feeding ourselves well in the future.

In my role with the Soil Association, we spend much time promoting healthy school meals, getting kids out on to farms to engage with real life, not just a computer game, and trying to persuade the government that investing in children's health will, as with our animals, pay dividends in the longer term. I still despair though. As with many farmers, we give more attention to the balanced diet and to the environment that our animals live in than society sometimes gives to rearing the next generation of humans.

Helen Browning – Extract from 'Pig'

MAY – SHEEP SHEARING



Eve Balfour, the founder of the Soil Association talked about food and farming being at the forefront of our National Health Service –

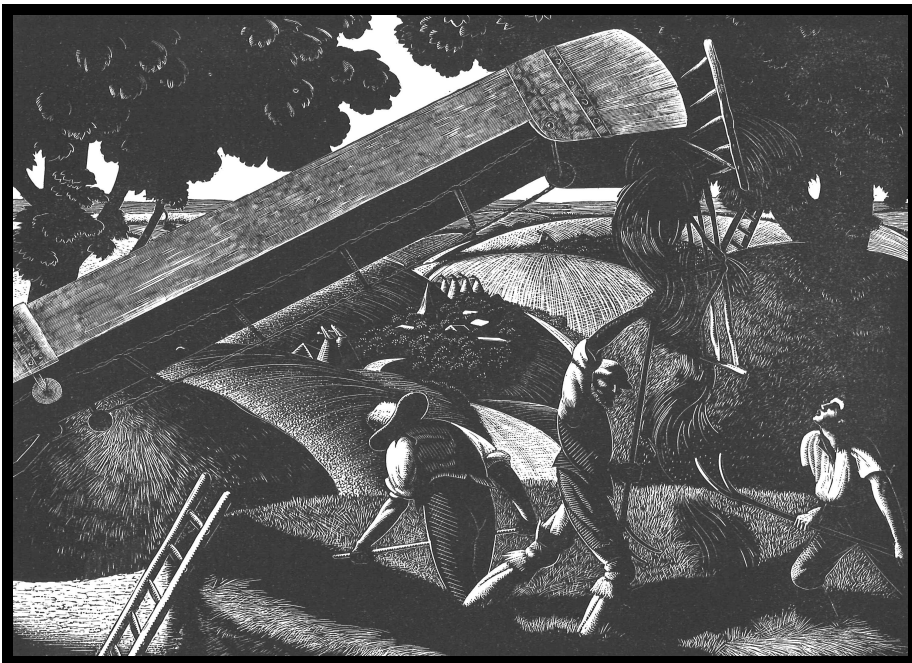
“If the nation's health depends on the way its food is grown, then agriculture must be looked upon as one the health services, in fact the primary health service. It is important to outgrow the attitude of confining the term health services to what are really sickness services.” “Any programme for the promotion of health that was based on soil fertility would raise political issues of the first order.”

Now feels like the moment when that philosophy could be put into practice more widely. In this 'unfrozen moment' anything is possible, good or bad, and it's the choices we make over the coming months and years that will swing the balance.

The Soil Association has just celebrated its 70th year. For much of this time, our message has been a candle in the wind, warning of the crazy short-term thinking that has led to all these problems, as well as to accelerating climate change, nutrient wastage on an epic scale, and the antibiotics crisis. People have disrupted the natural world for millennia, but our increasing numbers, and the power we can exert through our technologies, has allowed us to accelerate this impact extraordinarily over the last 100 years. This is a time for wisdom and long-term thinking; both have been in very short supply.

Helen Browning – Extract from 'Pig'

JUNE - HAYMAKING



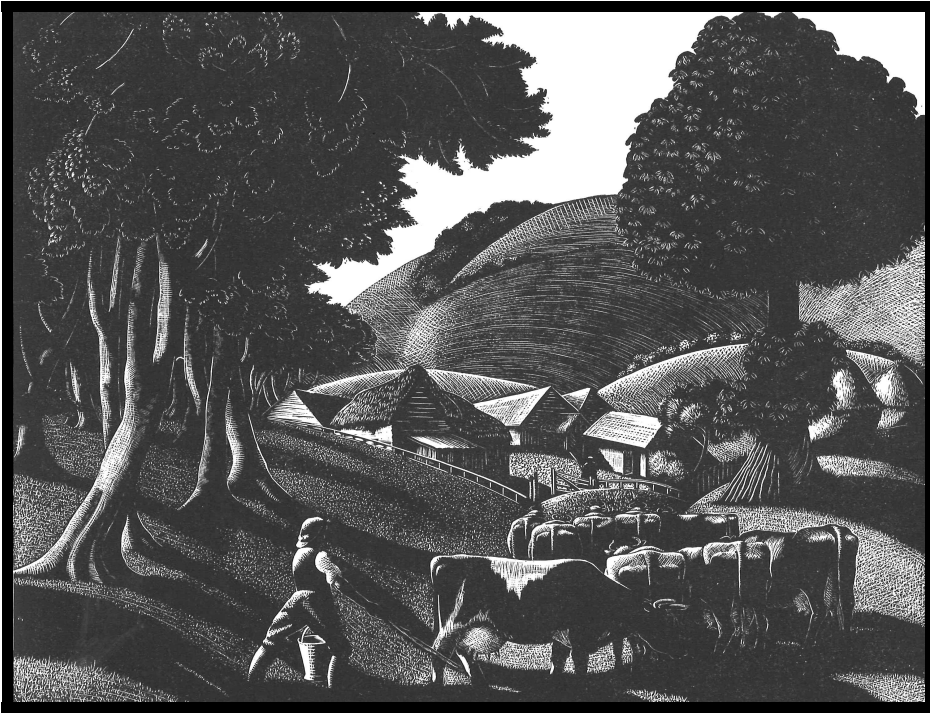
'The day heats up, and by afternoon it is over 22°C. You can almost hear the grass growing.'

The biggest challenge for us and other farmers is not having much idea what is around the corner. Weather is always our greatest unknown, and that is likely to become even more unpredictable with climate change.

Diversity is the watchword, in business as well as in ecology. There would still be broad-acre farming, producing cereals and potatoes, but at the very least it should follow organic principles, protecting soils, rotating cropping and avoiding pesticides. In the uplands, which are less important for producing food production but vital for water, carbon and wildlife, farmers would be paid to manage the land to secure these benefits, with modest numbers of livestock that support rather than destroy a varied and less denuded countryside, one that is attractive to visitors and therefore with increasing hospitality opportunities for rural communities. In the west, where the rainfall allows us to grow grass very efficiently without irrigation, grazing livestock are the best option for fertility building, while in the east, the drier soils would be perfect for pigs and poultry. The land there is crying out for the organic matter and fertility that free-ranging herds and flocks would provide, helping to sustain high yields of the arable crops that we need long into the future.

Helen Browning – Extract from 'Pig'

JULY – COTTAGE GARDENS

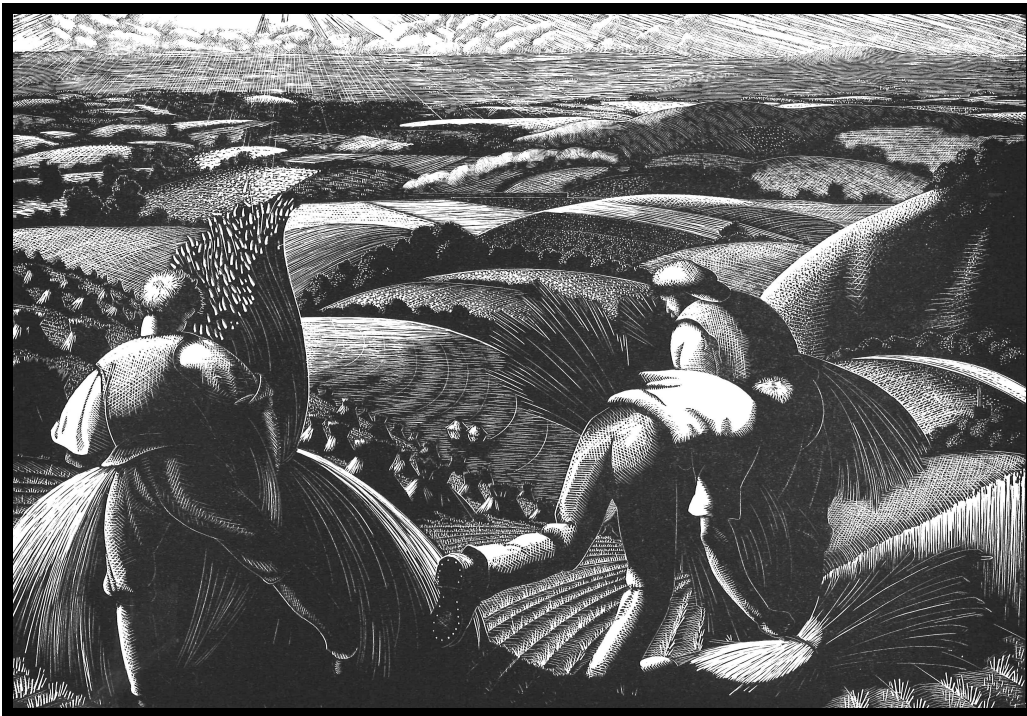


Today, land is the battleground, an increasingly impoverished battleground as we destroy the fertile soils that have developed over millennia. We are constantly expanding the land used for farming, often chopping down rainforest or ploughing out native grasslands in the name of feeding the growing population. Often, we are just feeding the animals that feed us. If we could satisfy our carnivorous instincts through a meat-like substitute, this could free up vast areas for nature. It's not an idea that plays well with most livestock farmers, however, and I understand their

fear. I love my pigs, and am not sure that I want to bring about a time when they won't be part of our farming life. But the world is changing very fast, and when we remember the many things - such as the internet and smart phones - which would have felt like science fiction 20 or 30 years ago, it's not inconceivable that before long much of our food may be generated from novel raw materials in high-rise, energy- and nutrient-efficient factories. The way we farm now, all our trials and tribulations with animals, weather and crops, could soon be a thing of the past.

Helen Browning – Extract from 'Pig'

AUGUST – HARVESTING



Beauty is frequently neglected and unrewarded by our often utilitarian view of the land, even though it's what many people value most. The awe that the land and its creatures inspires lifts our sights beyond day-to-day drudgery, much as music can, leaving us with a sense of our place in the world, as part of nature, part of the flow of life that relentlessly carries our genes, constantly evolving, constantly adapting, like a river towards the sea. As drops in that river, we are individually insignificant, but humanity's great gift is consciousness, of being able to watch for a brief moment this extraordinary flow of life, a miracle in the seemingly dead universe.

Momentarily we are snowflakes, each one unique as we drift towards the earth, with a perspective that few, if any, other species are granted.

This one is a partial one, however, so that this fragment of time when we are individually aware is also a danger. We tend to believe that the world, or at least the countryside, should be as we first knew it, without a sense of what came before. So I have grown up believing that these chalk uplands are as they were meant to be, open landscapes, grazing sheep and growing barley – but we have made them this way, albeit many hundreds, possibly thousands, of years ago now. Left to their own devices, scrub and woodland would regenerate, depending on the balance of other wild species that might make their home here.

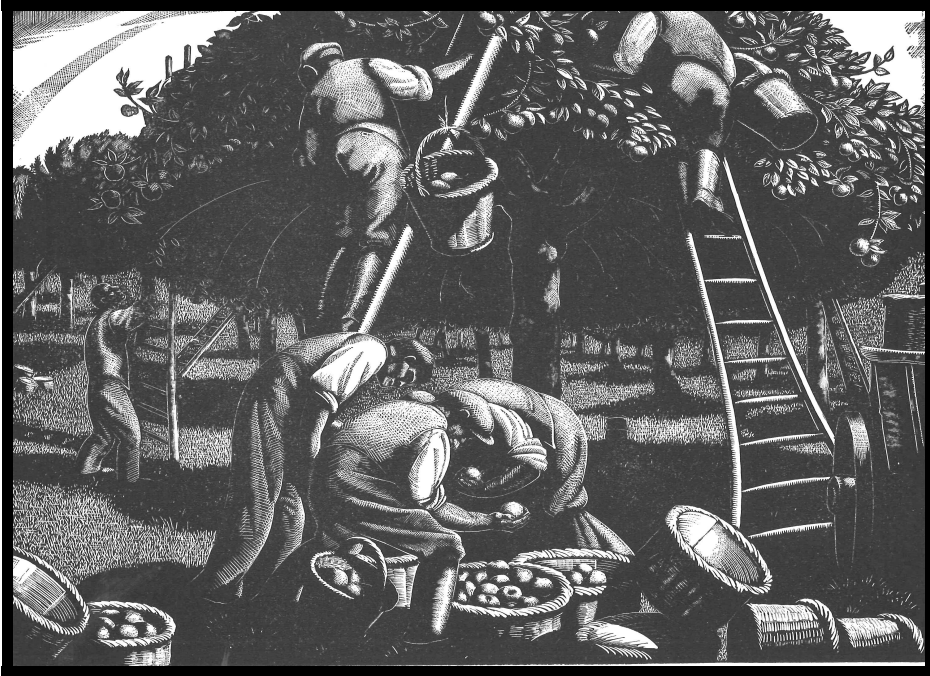
Most of our land in the UK has been shaped by humanity, and by our domesticated farm animals, which have replaced the wild ones. Beauty, then, is not just in the eye of the beholder, but is also only skin deep. What can seem a glorious sweep of green fields, may be aesthetically enhanced by a carefully positioned copse or hedgerow, can disguise a dead soil, reduced to a largely dead material by decades of arable cultivation, and no return of organic matter to feed its starving earthworms.

That deep greenness too, can be deceptive, the result of over-use of manufactured nitrogen, forcing the crop to grow faster than it should, weakening it so that it succumbs to disease, or pest attack. The chemicals we apply to cure these ails may then mean that even the copse or hedgerow, meant as a refuge for beleaguered wildlife, can become a death trap, especially for insects, as those chemicals leach into the more natural vegetation.

All is not as it seems. We need to look below the surface, to ensure that our instinctive empathy with the type of landscape that we recognise and perhaps feel safe in, is not just a hard-wired response which stems from our lack of a deeper understanding and a thoughtful imagination.

Helen Browning – Extract from 'Pig'

SEPTEMBER – APPLE PICKING



'The planting of trees for fruit, nuts, biomass and timber could be the basis of a revolution for climate change, our diets, water management and wildlife.'

If we could achieve only one thing in the turbulent years ahead, knocking down the barriers to tree planting and securing support for organic farming combined with agro-forestry and other ecological methods across the country, then I would feel more confident of the future for us, for wildlife and for a free-ranging, good life for our farm animals too. And while the political debates seem very current, that's not really the case. Many of them stretch back over centuries, playing out in parts of the globe: the extent to which we should protect our industries, including farming, and

strive for increasing national self-sufficiency; how we get the balance right between consumer affordability, fair trade, and the safety and ethical standards we should abide by; the assumed tensions between environmental and social objectives.

One of the many great things about trees is that they grow upright, catching sunlight from a different angle. As farming is essentially the art of catching sunlight and turning it into food, this means that an acre of land can produce much more if it has trees and shrubs as well as flat crops. It's three dimensional farming if you like.

Trees can draw nutrients up from deep in the soil, below the level that most crop roots will penetrate, so that minerals that might otherwise leech into watercourses can be captured, and some of them recycled into the topsoil as leaf litter. And they store carbon, vast amounts of it – as much as the soil itself – so at a time when we desperately need to reduce carbon in the atmosphere, trees have got a big role to play.

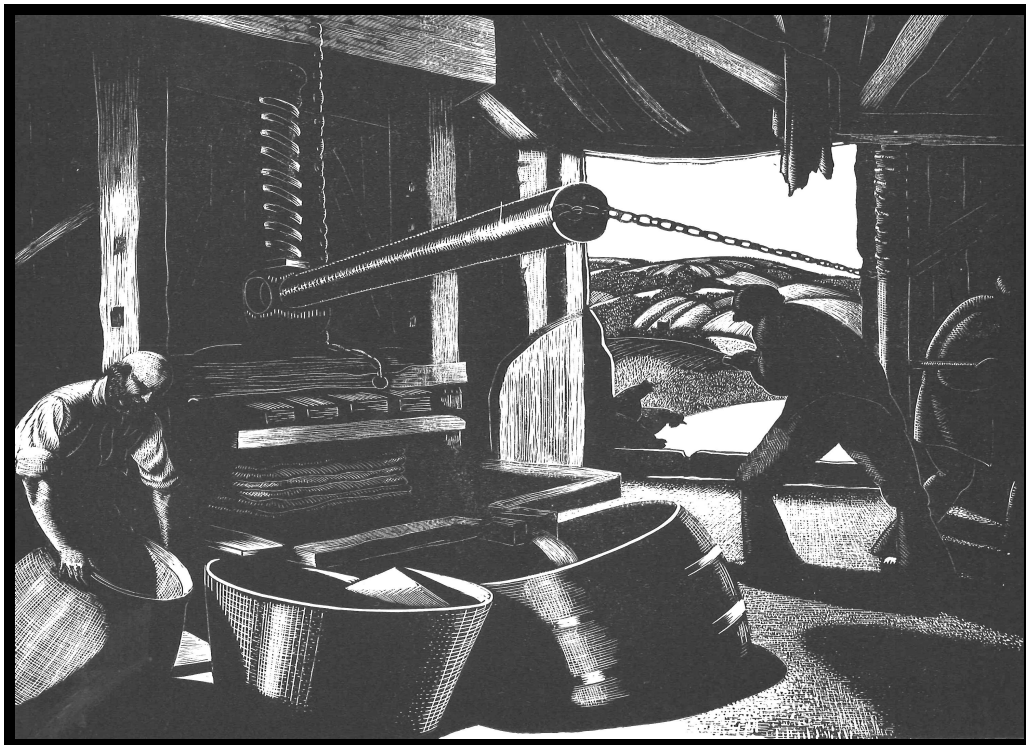
Until recently, we have tended to think that trees live in woods or forests, and, of course, that's a good place for them. But we've divided our land into 'woodland' and 'cropland' without thinking of the benefits of mixing them up. That's what I'm interested in: growing productive trees, whether for fruit, nuts, timber or biomass, on land which will also be cropped or grazed. This approach is called agro-forestry.

Of course, we have always had orchards, sometimes (but rarely commercially) with animals grazing within them. In the UK, though, we've destroyed most of our

orchards, and now import nearly 90% of our fruit. Growing fruit without chemicals is not easy in England; our warm, wet summers mean that diseases spread rapidly. In a traditional orchard, with trees close together, often on rootstocks that are designed for yield and ease of harvest rather than resilience, pesticides feel like an essential tool to many growers. But if we spaced the trees out more, this should be less of a problem.

Helen Browning – Extract from 'Pig'

OCTOBER – CIDER MAKING



The vast majority of food, probably the most important part of our daily lives, is no longer a local business, but a complex web of national and international trading. Our farm business is almost as guilty as anybody, in that while our animals are slaughtered quite locally, some 30 miles away, the cutting, processing and packing take place all over the country and, indeed, in Germany too. It's near impossible to find businesses that will manufacture the smallish batches we need, especially in organically certified facilities. For most farmers, processors and shoppers, food miles are a huge problem.

One big opportunity now, as I see it, is to invest in local and regional processing units for fruit and vegetable processing, and hubs to store and despatch dairy produce and genuinely fresh food, so that farmers and growers can get their food to customers quickly and efficiently, without a million middlemen who all take a margin. We end up wasting loads of food because it doesn't reach the retail specification, or because they've over-ordered; we over-process it to add shelf life and margin, then we over-package it to protect it through all the transport and storage it has to go through, so by the time it gets to the customer, it's either not very affordable, or not very healthy, or both. And despite all of this, most farmers will still be getting less than the cost of production; no wonder they are so worried about losing the EU support payments.

Helen Browning – Extract from 'Pig'

NOVEMBER - PLOUGHING



Probably the most important thing is soil organic matter. While we don't know much yet about all the billions of bugs in soil – some of them haven't been identified, let alone what they do – we do know that earthworms are a great indicator of a healthy soil.

So getting farmers to count them at the same time each year, ideally in the spring before the ground dries out and the worms burrow deep down, would help us appreciate how our farming methods can be improved to enable worms to thrive. Anything that gets farmers to put a spade into the ground regularly, to get to know what good structure looks like, and how the earth smells and fractures when handled.

I'm also intrigued by the advance in 'small smart machines', aka robots, and how they help us get off the tractor treadmill. Up to 90% of the energy going into tilling the soil is dealing with the problems caused by heavy machinery. It's a circular problem. The soil gets compacted by tractors, so it requires bigger tractors to pull bigger machines to repair the damage. It would be amazing to have little robots running around planting and weeding; they could go on the land when a tractor can't, and could navigate their way around the trees and hedges that often get ripped out, or not planted in the first place because they are a nuisance for big machines.

Helen Browning – Extract from 'Pig'

DECEMBER – FAT STOCK



'My life as a livestock farmer, with such a dependency on meat and milk for our living, puts me in a good position to understand the huge challenges that farmers face in moving to a 'less but better' world.'

If we all eat as much meat as the average American does - some 275 g/day per person - in the future, then we will certainly struggle to feed everyone adequately, without destroying what is left of nature, and doing massive damage to our environment too. But what does that mean for farmers like me?

Animals are a key part of our fertility-building cycle, making good use of the clovers that build the nitrogen in the soil, so that we can grow crops without energy-expensive manufactured fertilizer. And while water efficiency is one of the much cited downsides of eating beef rather than soya (for instance), does this matter in places where there is usually plenty of rain, and no need to irrigate?

While there is no doubt in my mind that we should reduce our consumption of animal products, it still seems to make sense to keep ruminant livestock in areas of the country and the world where there are great grass-growing conditions - though none whatsoever to be keeping them in areas that rely on irrigation.

I can understand those who want nothing to do with eating meat, and yet whatever we eat, however we live, we have blood on our hands. We chop down the rainforests to grow palm oil and soya, we destroy thousands of creatures and their habitats whenever we build a house or a road, we poison rats and mice – a ghastly death – and kill animals on the highway with our cars.

You don't have to look any further than your favourite David Attenborough programme to understand that in nature, everything is killing something else all the time. We are part of that nature, whether we like it or not. But we have a duty to tread more carefully on the earth. Even if we accept our self-assumed role as top predator, and have decided to domesticate animals rather than hunt them, we still need to understand the implications of eating meat.

Around a third of the crops we produce are fed to livestock, enough to feed another 3.5 billion people if we ate the crops rather than the animals. If we eat less meat and dairy - we need to be eating more of something else, more fruit and vegetables, more nuts and pulses, things that we grow too little of in the UK.

There is a host of challenges to increasing the production of these, as I know only too well from the experimenting we are doing on our farm. It's a big transition to make, one that will require research and investment in processing infrastructure and markets, and for tree crops especially, financial support for farmers during the time lag between planting and any commercial return.

Helen Browning – Extract from 'Pig'

THE PAUL BASSHAM
CHARITABLE TRUST